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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/035,027	12/28/2001	Xiangyang Zhuang	CR00311M(72463)	9194
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EXAMINER HO, CHUONG T				
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2419				
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/035,027

Applicant(s)

ZHUANG ET AL.

Examiner

CHUONG T. HO

Art Unit

2419

Period for Reply -- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 20 October 2008.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-8, 11, 19, 22, 23, 28 and 29 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 19, 22, 23, 28 and 29 is/are allowed.
- 6) ☒ Claim(s) 1-8, 11 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/888)
- Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
- Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

1. The Amendment filed 10/20/08 have been entered and made of record.
2. Applicant's arguments with respect to claims 1-8, 11, 19, 22, 23, 28, 29 have been considered but are moot in view of the new ground(s) of rejection.
3. Claims 1-8, 11, 19, 22, 23, 28, 29 are pending.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims, 1-2, 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Raleigh et al. (U.S. Patent No. 6,888,899) in view of Vila et al. (U.S. Patent No. 6,757,348).

In the claim 1, Raleigh '899 disclose providing a datastream comprised of bits (see figure 24, col. 27, lines 38-67 - col. 28, lines 1-47, symbol encoding receives and encodes the information bits in accordance with a particular encoding scheme to provide coded bits); comprising:
Interleaving (see figure 24, Symbol Interleaver 260) the bits of the datastream across a plurality of orthogonal frequency division multiplexing radio frequency transmitters

(figure 24, modulation 140) (see fig. 24, col. 27, lines 38-67 – col. 28, lines 1-47) (figure 9, figure 10, col. 14, lines 28-55, MIMO, OFDM);

wherein each of the radio frequency transmitters (figure 24, Transmit Antenna #1, ..., #M) transmits a plurality of radio frequency subcarriers, to provide interleaved bits wherein datastream bits are assigned to differing transmitters and differing subcarriers with low channel response correlation (col. 35, lines 48, uncorrelated between any two antenna outputs) to thereby exploit an increased amount of spatial (col. 18, lines 16-17, spatial processing is used to increase the received power of one or more parallel symbol streams) (col. 22, lines 26-27, modified spatial channel) and frequency diversity (col. 24, lines 24, frequency diversity);

Transmitting data that corresponds to the interleaved bits using the plurality of radio frequency subcarriers of the plurality of orthogonal frequency division multiplexed radio frequency transmitters (figure 24, col. 27, lines 38-67 – col. 28, lines 1-47).

However, Raleigh '899 are silent to disclosing wherein adjacent bits are assigned to different transmitters and different subcarriers.

Vila '348 discloses wherein adjacent bits (col. 4, lines 27-28, data symbols is use here in a generic sense and my comprise bits) (figure 3, data symbols 0, 1, 2, 3, 4, 5, 6, 7 are assigned communication links 34a, 34b, 34c, 34d, col. 4, lines 34-35, lines 8-13, lines 38-45) (col. 4, lines 26-27, datastream includes 32 data symbols) are assigned to different transmitters (figure 3, communication links 34a, 34b, 34c, 34d) and different subcarriers (see abstract, transmission lanes).

Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to apply the teaching of Vila '348 into the system of Raleigh '899, since Vila '348 recited the motivation in the col. 2, lines 21-23 which is enable data transfer over communications links having a plurality lines.

Regarding to claim 2, Raleigh '899 disclose wherein providing a datagram comprised of bits includes providing a datagram comprised of bits as provided from single source (figure 24, data source Bk) (col. 27, lines 38-67).

Regarding to claim 11, Raleigh '899 disclose wherein assigning datastream bits to differing transmitters (figure 24, Transmit Antenna #1 ...#M) and differing subcarriers with low channel response correlation (col. 35, lines 48, uncorrelated between any two antenna outputs) further comprising assigning datastream bits out of each encoder when multiple encoders are used to differing transmitters and different subcarriers with low channel response correlation (col. 35, lines 48, uncorrelated between any two antenna outputs) to thereby exploit an increased amount of spatial and frequency diversity for each encoded datastream (col. 18, lines 16-17, spatial processing is used to increase the received power of one or more parallel symbol streams) (col. 22, lines 26-27, modified spatial channel) and frequency diversity (col. 24, lines 24, frequency diversity);

However, Ling is silent to disclosing wherein adjacent bits are assigned to different transmitters and different subcarriers.

Vila '348 discloses wherein adjacent bits (col. 4, lines 27-28, data symbols is use here in a generic sense and my comprise bits) (figure 3, data symbols 0, 1, 2, 3, 4, 5, 6, 7 are assigned communication links 34a, 34b, 34c, 34d, col. 4, lines 34-35, lines 8-13, lines 38-45) (col. 4, lines 26-27, datastream includes 32 data symbols) are assigned to different transmitters (figure 3, communication links 34a, 34b, 34c, 34d) and different subcarriers (see abstract, transmission lanes).

Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to apply the teaching of Vila '348 into the system of Raleigh '899, since Vila '348 recited the motivation in the col. 2, lines 21-23 which is enable data transfer over communications links having a plurality lines.

5. Claims 3-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combined system (Raleigh '899 - Vila '348) in view of Sarraf et al. (U.S. Patent No. 6,747,948 B1).

In the claim 3, the combined system (Raleigh '899 - Vila '348) disclose the limitations of claim 1 above.

However, the combined system (Raleigh '899 - Vila '348) are silent to disclosing providing datastream comprised of bits includes providing a datastream comprised of bits as provided from a plurality of sources.

Sarraf '948, see figure 2, discloses the signal generation unit modulates a plurality of subcarriers, which may be OFDM sub-carriers, based on the interleaved

substream and upconverts the modulated subcarriers for transmission (see col. 2, lines 32-35); comprising:

- providing datastream comprised of bits includes providing a datastream comprised of bits as provided from a plurality of sources (see col. 2, lines 20-22, the encoder receives blocks of source data from one or more data sources).

Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to apply the teaching of Sarraf '948 into the combined system (Raleigh '899 - Vila '348), since Sarraf '948 recited the motivation in the col. 1, lines 10-12, which improve the performance of error correction decoders.

Regarding to the claim 4, the combined system (Raleigh '899 - Vila '348) discloses the limitations of claim 3 above.

However, the combined system (Raleigh '899 - Vila '348) are silent to disclosing providing a datastream comprised of bits as provided from a plurality of sources includes providing a datastream comprised of bits as provided from a plurality of sources wherein at least some of the bits as provided from at least one of the plurality of sources are encoded bits.

Sarraf '948 discloses providing a datastream comprised of bits as provided from a plurality of sources (see col. 2, lines 20-22, the encoder receives blocks of source data from one or more data sources) includes providing a datastream comprised of bits as provided from a plurality of sources (see col. 2, lines 20-22, the encoder receives

blocks of source data from one or more data sources) wherein at least some of the bits as provided from at least one of the plurality of sources are encoded bits (encoding unit 16, see figure 2) (see col. 3, lines 27-55).

Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to apply the teaching of Sarraf '948 into the combined system (Raleigh '899 - Vila '348), since Sarraf '948 recited the motivation in the col. 1, lines 10-12, which improve the performance of error correction decoders.

In the claim 5, the combined system (Raleigh '899 - Vila '348) disclose the limitations of claim 3 above.

However, the combined system (Raleigh '899 - Vila '348) are silent to disclosing providing a datastream comprised of bits includes providing a datastream comprised of encoded bits.

Sarraf '948 disclose providing a datastream comprised of bits includes providing a datastream comprised of encoded bits (encoded data, see abstract) (see col. 3, lines 27-55).

Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to apply the teaching of Sarraf '948 into the combined system (Raleigh '899 - Vila '348), since Sarraf '948 recited the motivation in the col. 1, lines 10-12, which improve the performance of error correction decoders.

Regarding to the claims 6, the combined system (Raleigh '899 - Vila '348) disclose the limitations of claim 3 above.

However, the combined system (Raleigh '899 - Vila '348) are silent to disclosing a datastream comprised of encoded bit includes providing a datastream comprised of convolutionally encoded bits.

Sarraf '948 discloses a datastream comprised of encoded bit includes providing a datastream comprised of convolutionally encoded bits (see col. 3, lines 27-55).

Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to apply the teaching of Sarraf '948 into the combined system (Raleigh '899 - Vila '348), since Sarraf '948 recited the motivation in the col. 1, lines 10-12, which improve the performance of error correction decoders.

Regarding to the claim 7, the combined system (Raleigh '899 - Vila '348) disclose the limitations of claim 3 above.

However, the combined system (Raleigh '899 - Vila '348) are silent to disclosing providing a datastream comprised of encoded bits includes providing a datastream comprised of serially concatenated convolutionally encoded bits.

Sarraf '948 discloses providing a datastream comprised of encoded bits includes providing a datastream comprised of serially concatenated convolutionally encoded bits (see col. 3, lines 27-55).

Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to apply the teaching of Sarraf '948 into the combined system (Raleigh

'899 - Vila '348), since Sarraf '948 recited the motivation in the col. 1, lines 10-12, which improve the performance of error correction decoders.

Regarding to the claim 8, the combined system (Raleigh '899 - Vila '348) disclose the limitations of claim 3 above.

However, the combined system (Raleigh '899 - Vila '348) are silent to disclosing providing a datastream comprised of encoded bits includes providing a datastream comprised of parallel.

Sarraf '948 disclose providing a datastream comprised of encoded bits includes providing a datastream comprised of parallel (see col. 3, line 21) concatenated convolutionally encoded bits (see col. 3, lines 27-55).

Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to apply the teaching of Sarraf '948 into the combined system (Raleigh '899 - Vila '348), since Sarraf '948 recited the motivation in the col. 1, lines 10-12, which improve the performance of error correction decoders.

Allowable Subject Matter

6. Claims 19, 22, 23, 28-29 are allowed.
7. The following is an examiner's statement of reasons for allowance: Claim 19 is allowed. The prior art of record does not appear to teach or render obvious the claimed limitations in combination with the specific added limitations, as recited from

independent claim 28: "wherein demodulation include the use of a zero forcing symbol metric estimator based on ("ln" stands for the natural logarithm) $\ln P(\dots)$ where S is the estimated symbol at the Kth subcarrier of the Jth transmitted antenna, i.e. $[..] = w, y_k$ with filter matrix W_k being the zero forcing matrix computed based on the channel matrix H_k and where $W_k(:,j)$ denoted the jth column of W_k "II.II" denotes the vector nome, O is the noise power, and S is any of the constellation symbols".

8. The following is an examiner's statement of reasons for allowance: Claim 22 is allowed. The prior art of record does not appear to teach or render obvious the claimed limitations in combination with the specific added limitations, as recited from independent claim 29: "wherein demodulation include the use of a minimum mean squared error symbol metric estimate based on ("ln" stands for the natural logarithm....is the average symbol power, and S is any of the constellation symbols".

9. The following is an examiner's statement of reasons for allowance: Claim 23 is allowed. The prior art of record does not appear to teach or render obvious the claimed limitations in combination with the specific added limitations, as recited from independent claim 19: "demodulating the received multi-antenna transmission signals to data bits from bit metrics computed by using a maximum likelihood bit soft information estimator represented by

$$P(Y(k) | B(l, k)) = \sum_{S \in \mathcal{S}} \text{seSi}(P(Y(k) | S(k) = S) P(S(k) = S)$$

Where $P(Y(k) | B(l, k))$ is a probability of observing received signals $Y(k)$ at the Kth subcarriers on at least one antenna under the condition of transmitting bit $B(l, k)$ (0 or

1), and $S(i)$ a set of all symbol vectors whose bit representations contain the given value of the bit of interest $B(l, k)$.

10. The following is an examiner's statement of reasons for allowance: Claim 28 is allowed. The prior art of record does not appear to teach or render obvious the claimed limitations in combination with the specific added limitations, as recited from independent claim 22: "demodulating the received multi-antenna transmission signals to recover data bits from bit metrics computed by using a zero forcing bit metric estimator represented by

$$P(s(j, k) | B(l, k)) = \sum_{s \in S(i)} \exp \left\{ - \frac{\|s(j, k) - s(o)\|^2}{2 \sigma^2} \right\} / \sum_{s \in S(i)} \exp \left\{ - \frac{\|s(j, k) - s(o)\|^2}{2 \sigma^2} \right\}$$
.....and $S(i)$ is a set of constellation symbols whose bit representations contain the given value of the bit of interest $B(l, k)$.

11. The following is an examiner's statement of reasons for allowance: Claim 29 is allowed. The prior art of record does not appear to teach or render obvious the claimed limitations in combination with the specific added limitations, as recited from independent claim 23: "demodulating the received multi-antenna transmission signals to recover data bits from bit metrics computed by using a minimum mean squared error bit metric estimator represented by.....and $S(i)$ is a set of constellation symbols whose bit representations contain the given value of the bit of interest $b(l, k)$.

Conclusion

12. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. El-Gamal; Hesham (7,010,053).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to CHUONG T. HO whose telephone number is (571)272-3133. The examiner can normally be reached on 8:00 am to 4:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, EDAN ORGAD can be reached on (571) 272-7884. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

01/03/09

/Edan Orgad/

Supervisory Patent Examiner, Art Unit 2419